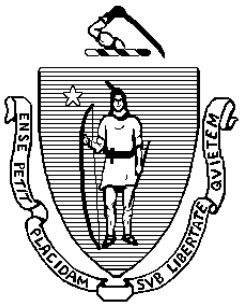

The Commonwealth of Massachusetts

DEPARTMENT OF PUBLIC UTILITIES

Incident Report

72 Austin Road, Sudbury, Massachusetts
January 13, 2004

PIPELINE ENGINEERING AND SAFETY DIVISION

Accident File 04 - 01

Location: Sudbury, Massachusetts

Date of Accident: January 13, 2004

Gas Company: KeySpan Energy Delivery - New England

Property Damage: $20,000 *

Injuries: None

Report Issued - November 2008

* Estimated by KeySpan Energy Delivery - New England

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I. INTRODUCTION

A. Scope of this Investigation

The Pipeline Engineering and Safety Division ("Division") of the Massachusetts Department of Telecommunications and Energy (the "Department"), pursuant to G.L. c. 164, § 105A and G.L. c. 82, § 40 ("Dig Safe"), has investigated a release of natural gas ("gas") that ignited at 72 Austin Road, Sudbury, MA, which occurred on January 13, 2004 ("Incident").[1] The operator of the pipeline was KeySpan Energy Delivery, New England ("Operator"). The Incident resulted in approximately $20,000 of property damage, as estimated by the Operator (Exh 1.). There were no injuries as a result of the Incident.

As part of the Department's annual certification process by the United States Department of Transportation ("DOT"), the Department must report to the DOT

> [e]ach accident or incident . . . involving a fatality, personal injury requiring hospitalization, or property damage or loss more than an amount the Secretary establishes, any other accident the [Department] considers significant, and a summary of the investigation by the authority of the cause and circumstances surrounding the accident or incident.
> 49 U.S.C. § 60105(c)

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[1] Incident means any of the following events:
(1) An event that involves a release of gas from a pipeline or of liquefied natural gas or gas from an LNG facility and
(i) A death, or personal injury necessitating in-patient hospitalization; or
(ii) Estimated property damage, including cost of gas lost, of the operator or others, of $50,000 or more.
(2) An event that results in an emergency shutdown of an LNG facility.
(3) An event that is significant, in the judgement of the operator, even though it did not meet the criteria of paragraphs (1) or (2). 49 CFR § 191.3.

The purpose of this report is to inform the DOT of the cause and circumstances surrounding the Incident.

The Department has established procedures for determining the nature and extent of violations of codes and regulations pertaining to the safety of pipeline facilities and the transportation of gas, including but not limited to, 220 C.M.R. §§ 101.00 through 113.00. See 220 C.M.R. §§ 69.00 et seq. The Department also enforces the DOT safety standards for gas pipeline systems as set forth in 49 C.F.R. § 192 et seq. The Department has delegated to its Pipeline Engineering and Safety Division ("Division") authority to conduct investigations regarding compliance or noncompliance with gas safety codes. Order of Delegation, D.P.U. 86-23 (1986).

B. Overview of Incident

On January 13, 2004, there was a release of gas and ignition at 72 Austin Road, Sudbury which resulted in fire damage to one side of the home (Exh. 1). The Sudbury Fire Department ("fire department") responded to the explosion and fire. There were no injuries as a result of the fire (id.).

During the investigation that followed the incident, KeySpan observed gas blowing out of the ground near the high pressure service riser to 72 Austin Road (id.). The KeySpan crew disconnected the service riser union, pulled the riser away from the plastic service, and shut off the gas (id.). The operator proceeded to squeeze off the plastic service line approximately seven inches away from the end of the riser (id.). Upon completion of its leak investigation,

KeySpan determined that a source of the gas was the service line riser (id.). There were no other leaks detected in the area (id.).

Based upon our investigation, the Division has determined that the cause of the incident at 72 Austin Road was the ignition of an accumulation of natural gas in the furnace ventilation system. The metallurgical report stated that the source of the gas leak was a crack in a gasket of a universal joint fitting located above the shutoff valve on the service line riser. The ignition source was the furnace burner.

II. BACKGROUND

Austin Road is a residential area in Sudbury. The area is comprised of single family homes. The structure at 72 Austin Road is a two-story house. The natural gas service line supplied one gas meter located on the outside basement wall of the house.

The one-half inch plastic service line was installed on November 6, 1971. The operating pressure of the service is 6-7 inches water column[2] ("in. w. c.") (Exh. 1). The pressure feeding the service prior to being reduced by the service regulator was 38 pounds per square inch gauge ("p.s.i.g."). The frost level in the area extended three to four inches.

III. THE DEPARTMENT'S INVESTIGATION

On January 13, 2004, at approximately 7:17 a.m., the Sudbury Fire Department received a call from the homeowner of 72 Austin Road, Sudbury stating that her house was on fire (Exh. 1). The homeowner and her daughter were home when she smelled a strong odor of

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[2] Inches water column - a measurement of pressure with 27.71 inches of water column equating to one pound per square inch gauge.

gas and then heard an explosion (Exh. 2). She was able to evacuate the house without injury (id.). Upon their arrival, the fire department found fire showing outside of the building, around the gas meter and the shut-off valve. They also believed that there was a possibility that the fire had spread to the interior of the building (Exh. 1).

KeySpan received a call at 7:29 a.m. from the Sudbury Fire Department requesting their assistance at the explosion site (id.). The fire department requested that KeySpan shutoff gas to a fire at 72 Austin Road, Sudbury (id.). While waiting for KeySpan personnel to arrive, the fire department attempted to shutoff the gas by closing the valve at the gas meter (Exh. 5).[3] When KeySpan personnel arrived at the scene, there was still gas blowing out of the ground (id.). The service was shutoff when the crew disconnected the riser union and pulled the riser away from the plastic service. The crew dug up the riser by hand and squeezed off the plastic pipe approximately seven inches from the end (id.). The vent on the riser was not leaking. However, the cap and the spring on the regulator were missing (id.). While KeySpan was attempting to shutoff the natural gas service, the fire department set up a fan to blow gas away from the house (id.).

KeySpan removed the meter and service line riser. Upon removal of the natural gas assembly, they noticed that the intake and exhaust vents for one of the furnaces supplying the home were located behind the meter. (id.). The vents were installed after the meter (Exh. 1, 2). KeySpan and the Sudbury Fire Department concluded that the leak from the service riser

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[3] In addition, KeySpan unsuccessfully attempted to locate the underground curb shut off buried near the property line (Exh. 1). It is required on certain service lines by 220 C.M.R. 101.06(14).

was drawn into the intake creating a delayed ignition in the furnace which backfired out of the exhaust and ignited the leaking gas from the service on fire (id.). The vent and heating system had been installed approximately two years prior to the incident (Exh. 2).

KeySpan did not notify the Division of the incident. The Division was notified of the incident by a third party who had read about the explosion in the MetroWest News. After receiving this information, a Division inspector contacted KeySpan's Waltham Area Supervisor. He informed the inspector that he was not aware that the Division had not been notified of the incident (Exh. 3). The inspector made arrangements to take custody of the meter assembly that was removed from the accident scene.

IV. LEAK INVESTIGATIONS, MAINTENANCE AND REPLACEMENT ACTIVITY

KeySpan had not responded to any house calls or maintenance at this location since the service installation in 1971 (Exh. 1).

In order to identify whether this service had any prior leaks, the Division reviewed leak history of the services underlying Austin Road. Leakage surveys of services are required by federal and state regulations. The last leakage survey of service lines was conducted in 2001. There were no leaks detected. After the incident, KeySpan conducted a leak investigation. This survey did not detect any other leaks in the area (Exh. 1).

V. FAILURE ANALYSIS OF PIPE SAMPLE

Massachusetts Materials Research, Inc. ("MMR") conducted a failure analysis of the 72 Austin Road service riser. The purpose of the testing was to determine the probable cause of the failure of the service riser. MMR's analysis included visual inspection, leak testing,

chemical analysis, fracture analysis, and radiographic inspection.

On February 21, 2006 MMR submitted its results to the Department.[4] MMR's conclusions and recommendations are summarized below:

> A fracture of the universal joint nylon gasket provided a pathway for the release of gas from the piping system at 72 Austin Road, Sudbury, MA. This fracture was a brittle overload fracture, a one-time (as opposed to progressive) event. This means that prior duct work in the vicinity of the gas piping did not result in damage that propagated over time. This crack appears to be the result of the combination of extrusion, some degradation of the nylon, and temperature effects.
>
> The material of construction of this gasket, Nylon 6, 6-6, is known for poor dimensional stability and water absorption from the environment. Since the universal joint design leaves some gasket open to the environment, this means that the conditions that caused the crack leading to this incident could combine again with another gasket of this same joint design, material, and vintage.
>
> MMR recommended that gaskets of the same type and material in other services be replaced, since the crack that led to this incident resulted from a combination of events that could combine again. This replacement program should begin with the oldest gaskets and proceed to newer ones. There appears to be no reason to recommend a material change for these gaskets. Recognition of the life span of equipment should be used to develop ongoing updating and replacement programs. Gaskets of this material not exposed to the ambient environment should not have been adversely affected by water absorption as natural gas service is dry.
> Id.

VI. FINDINGS AND CONCLUSIONS

A. Findings

1. The homeowner called the Sudbury Fire Department at 7:17 a.m. to notify them of a fire at her home located at 72 Austin Road, Sudbury.
2. The fire department was on site at 7:21 a.m.
3. KeySpan's dispatch office received a call from the fire department at 7:29 a.m.
4. The fire department extinguished a fire outside the building at the location of the gas meter.

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[4] Copies of MMR's report can be obtained by contacting: Massachusetts Materials Research, Inc., P.O. Box 810, 1500 Century Drive, West Boylston, MA 01583.

5. The fire department closed the shut-off valve at the meter.
6. The fire department stated that shutting this valve off did not stop the flow of gas.
7. KeySpan arrived at the scene at 8:15 a.m.
8. KeySpan was unable to find the curb cock to shutoff the service line.
9. KeySpan hand dug the service riser and squeezed off the plastic pipe to stop the flow of gas that was leaking from the riser.
10. KeySpan noticed an intake and exhaust vent located behind the regulator servicing 72 Austin Road.
11. KeySpan conducted a leakage survey and detected no gas readings in vicinity of 72 Austin Road.
12. MMR concluded that the source of the accumulation of gas at 72 Austin Road was a crack in a universal joint nylon gasket located above the service line shutoff.
13. The ignition source was a furnace located in the basement. The natural gas entered the basement through vent lines attached to the furnace.
14. KeySpan estimated the property damage to be no more than $20,000.
15. The one half inch service line was installed on November 6, 1971.

B. Conclusions

Based on the Division's review of the facts presented, it appears that the explosion at 72 Austin Road, Sudbury, was caused by the ignition of natural gas that was drawn into the basement of the house through an intake vent for the furnace. The ignition source was a furnace. The source of the natural gas leak was a crack in a universal joint nylon gasket located above the service line shutoff valve. The conditions that caused the fracture of the gasket could exist with another gasket similar in design, material and vintage. Therefore, the Division concludes that KeySpan must review the recommendations outlined in the MMR report and present to the Division a plan to minimize the possibility of recurrence of this type of failure as required by the federal code in 49 C.F.R. Part 192, §192.617.

Appendix

Exhibit List

1. KeySpan's Responses to D.T.E. Information Requests - February 25, 2004, and March 6, 2006

2. Memo from Angela Motley, D.T.E. Engineer to File - January 23, 2004

3. Memo from Angela Motley, D.T.E. Engineer to File - January 14, 2004

4. Photographs of the Incident Site

5. Fire Department Incident Report

EXHIBIT 1

KeySpan's Responses to D.T.E. Information Requests
February 25, 2004 and March 6, 2006

EXHIBIT 2

Memo from Angela Motley, D.T.E. Engineer to file
January 23, 2004

EXHIBIT 3

Memo from Angela Motley, D.T.E. Engineer to file
January 14, 2004

EXHIBIT 4

Photographs of the Incident Site

Front view of house.
Gas meter is located on the left side of the house near the chimney.

Newly installed gas meter and regulator.
The furnace intake vent pipe has been removed (location of small board).

Damage to interior wall of home.
The gas meter is located outside, directly behind this wall.

Outside damage to the home (left side of house).

Hole in ceiling in the basement.
This is in close proximity to the gas meter.

Basement area - showing one of the two furnaces.

EXHIBIT 5

Fire Department Incident Report